REMARKS

The Examiner's action and the objections and rejections set forth therein have been carefully considered and the application has been amended accordingly. Claims 1 and 18 have been amended to include the additional feature, disclosed in the second full paragraph of page 10 of the specification and in the brief description of Figure 3 (page 7), wherein the first source of illumination emits light that is at least partially diffuse. It is believed that, as amended, the subject matter of claims 1 and 18 are patentable over the cited prior art for the reasons set forth hereinafter. In addition, claim 5 has been rewritten in independent form and is likewise believed patentable over the cited prior art for the reasons set forth hereinafter. Furthermore, the applicant gratefully acknowledge the Examiner's indication that claims 6-10, 12-15, 19 and 21-23 would be allowable if rewritten in independent form. Accordingly, claims 6 and 19 have been rewritten in independent form. Finally, responsive to the objection to the drawings, a replacement sheet is submitted herewith containing an amended Figure 3 showing the defective places beneath the transparent protective layer.

Claims 1-4, 11, 16-18 and 20 are believed to be allowable over the cited art in view of the amendments to claims 1 and 18. Claim 5 is believed to be allowable over the cited art and reconsideration of the rejection of claim 5 is respectfully requested, all for the reasons hereinafter presented.

Applicant's invention, as embodied in claims 1 and 18, is directed to a method and arrangement for the optical inspection of a transparent protective layer and of a colored patterned surface, whereby the transparent protective layer at least partially covers the colored patterned surface. As is described in the introductory portion of the specification, arrangements known from the prior art are not capable of recognizing slight defects inside the transparent protective layer. Specifically, detection with one or more color cameras under diffuse incident illumination does not recognize typical defects inside the transparent protective layer such as, for example, slight milkiness or localized tears in the protective layer. This is because the undirected reflection of the diffuse incident illumination is mainly modulated by the colored decor film, but hardly by typical defects inside the transparent protective layer. A black-and-white camera that

picks up the light from a directed source of incident illumination that is reflected off the surface can detect local defects in the gloss and in the integrity of the surface, but this illumination hardly penetrates into the transparent protective layer and is thus changed only slightly or not at all as a result of defects inside the protective layer.

In the method and arrangement according to the present invention, the protective layer is illuminated with light emitted by a source of illumination that emits shortwaved light in the range that is visible for the first imaging sensor and that is at least partially diffuse. The light that strikes the surface penetrates at least partially into the protective layer and is scattered at the defective places. The light scattered back from the defective places is picked up with the imaging sensor and defective places are recognized by the local increase in the intensity of the light picked up by the imaging sensor in the area of the defective places. The diffuse illumination has the advantage that the optical effect on the detected scatter image caused by any embossing of the surface is minimized. Thus, defects inside and beneath a transparent layer with an embossed surface can also be detected with the method and arrangement of the present invention.

Turning first to the rejections of claims 1-4, 11, 16-18 and 20, which stand rejected under 35 USC 103(a) as being unpatentable over Hack (U.S. Patent No. 4,725,139) in combination with Kinney et al (U.S. Patent No. 6,809,809) (claims 1, 2, 4 and 18), Kvamme (U.S. Patent No. 6,879,390) (claim 3), Wertz et al (U.S. Patent No. 5,374,988) (claims 11 and 20), Lin (U.S. Patent No. 6,319,349) (claim 16) and Buoni et al (U.S. Patent No. 6,375,776) (claim 17), it is respectfully submitted that independent claims 1 and 18, as amended, are allowable over this cited art.

The Hack et al patent teaches a method of detecting defects inside a transparent material. According to Hack et al's method, the transparent material is scanned with a laser beam which partially penetrates into the transparent material and is scattered or reflected at faults located inside the material. The scattered or reflected laser beam is detected by an optical sensor. The wave length of the laser is chosen so that only faults in a specific depth region of the transparent material make a contribution to the reflected and scattered laser beam. By varying the wave

length of the laser, faults in the entire depth of the transparent material can be detected, making it possible to associate detected faults with specific depth layers in the transparent material. A laser is used in the preferred arrangement of the reference since a laser is characterized by a monochromatic light (to allow faults only in a specific depth region to be detected) and the wave length can be freely selected within limits (to allow faults throughout the entire depth of the transparent material to be detected). Further, a laser is, due to the optical cavity, characterized by a very directed light characteristic. Thus, the patent to Hack et al does not show the feature of amended claims 1 and 18 wherein the shortwaved light is at least partially diffuse. Consequently, the method and arrangement according to Hack et al cannot detect faults located inside a transparent material having an embossed surface. Moreover, it would not have been obvious from Hack et al (which teaches a highly directed laser beam) or any other reference of record to use a light source that is configured to emit light that is at least partially diffuse in order to minimize the optical effect on the detected scatter image caused by embossing of the transparent material. Indeed, the teachings of Hack et al lead away from the use of a light source having a diffuse light characteristic.

In the various combination rejections under 35 USC 103(a), the Examiner relies upon secondary references which do not show or suggest a method or arrangement for the optical inspection of faults located inside and beneath a transparent protective layer covering a colored patterned surface wherein the light source used for the inspection emits light that is at least partially diffuse for minimizing the optical effect on the detected scatter image caused by embossing on the surface of the transparent layer. Accordingly, none of the secondary references make up for the disclosure deficiencies of Hack et al and, for this reason, no combination of Hack et al and any of the secondary references can make claims 1 and 18, and any claims dependent therefrom, obvious within the meaning of 35 USC 103(a). Therefore, reconsideration of the 35 USC 103(a) rejections over Hack et al in view of a secondary reference, as applied to claims 1-4, 11, 16-18 and 20, and withdrawal of these rejections, is respectfully requested.

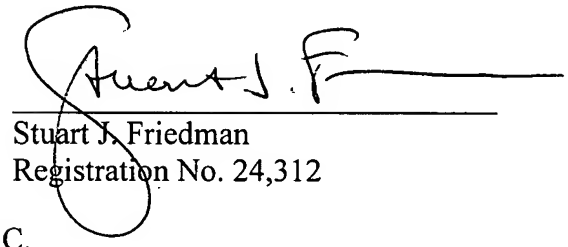
Claim 5 has been rewritten in independent form as originally presented. Claim 5 stands

rejected under 35 USC 103(a) as unpatentable over Hack et al in view of Deck (U.S. Publication No. 2003/0160968). Claim 5 is directed to a preferred method of the present invention in which the light emitted by the first source of illumination is imaged in the form of a line on the surface of the transparent protective layer, i.e., the first imaging sensor "sees" a bright line on the surface of the protective layer. The back-scattered light in the area of the defective places causes a widening of the line, which is again "seen" by the first imaging sensor.

The Hack et al patent has already been discussed. The Examiner relies upon Deck at paragraph [0177], lines 7-15 as teaching imaging in the form of a line on the surface of the transparent protective layer and the widening of the line caused by the back-scattered light in the area of the defective places. However, in paragraph [0177] to which the Examiner refers, a method for detecting defects in a transparent plate is described in which a reference plate is positioned parallel to the transparent plate. An incident light beam is reflected at the surfaces of the transparent plate and the reference plate and is scattered back at defects located in the transparent plate. A CCD camera detects a superposition of the reflected and scattered beams and generates an interference signal proportional to the intensity of the superposition. Deck does not disclose or suggest to image the light in the form of a line on the surface of the transparent plate wherein defects inside the transparent plate are detected by means of a widening of this line. Accordingly, the combination of Hack et al and Deck do not amount to a teaching of the subject matter of claim 5 nor do they render that subject matter obvious within the meaning of 35 USC 103(a). Therefore, the rejection of claim 5 over Hack et al in view of Deck should be reconsidered and withdrawn.

It is respectfully submitted that claims 1-5, 11, 16-18 and 20 are now allowable for the reasons set forth hereinabove. Claims 6-10, 12-15, 19 and 21-23 are allowable because they have been rewritten in independent form. Accordingly, an early Notice of Allowance directed to all claims in the application is courteously solicited.

Respectfully submitted,



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